APPENDIX F

TECHNICAL REPORT ON

WATER

BP CHERRY POINT COGENERATION PROJECT

[REVISED]

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EXECUTIVE SUMMARY

This technical report addresses the required information on Water for the BP Cherry Point Cogeneration Project (Cogeneration Project), as outlined within the Potential Site Study (PSS) issued by the Washington State Energy Facility Site Evaluation Council (EFSEC).

Project Description

The proposed Cogeneration Project would be a combined cycle (steam and electricity) facility located at the BP Cherry Point Refinery (Refinery), which is near Ferndale and Blaine in northwestern Whatcom County, Washington. The proposed Cogeneration Project would use a state-of-the-art high-efficiency power generation system use clean-burning natural gas. The plant would produce a nominal 720 megawatts (MW) and would be configured with three natural gas-fired combustion turbines (each driving one electric generator) and three heat recovery steam generators driving a common steam turbine ~~driving one~~ electric generator.

The entire project, including the Cogeneration plant and support facilities, the new transmission line, natural gas and water supply lines, and construction laydown areas would be on BP Refinery-owned property, immediately adjacent to the existing Refinery which has operated at this site since 1971. The Refinery and proposed Cogeneration Project site are contained within the Cherry Point Major Industrial Urban Growth Area/ Port Industrial Zone, as defined in the Whatcom County Comprehensive Plan.

The entire project area is zoned Heavy Impact Industrial. The Cogeneration Project site would occupy approximately 33 acres of unimproved land immediately adjacent to the Refinery.

Water Consumption

BP initially proposed that the Cogeneration Project would use an air-cooled condenser to minimize the consumption of fresh water. However, the initial Application for Site Certification also indicated that BP was evaluating the potential for reusing industrial wastewater in a conventional evaporative cooling system. BP has completed that evaluation and now proposes to go forward with an evaporative cooling system using recycled once-through cooling water from the nearby Alcoa aluminum smelter.

The Whatcom County Public Utility District No. 1 (PUD), BP and Alcoa entered into a letter of intent to develop a water reuse project. The Cogeneration Project would fund the project, which would be implemented by the PUD at the Alcoa aluminum smelter. Alcoa would return water that it currently used in a non-contact, once-through cooling process. The PUD would then provide that water for use in the Cogeneration Project and the Refinery.

The Cogeneration Project would require an average of 2,244 to 2,316 gallons per minute (gpm) of water for operation, which is approximately 3.2 to 3.3 million gallons per day (mgpd). The PUD would recycle approximately 2,870 gpm of once-through cooling water from Alcoa, which would reduce the water needed to be withdrawn from the Nooksack River by an average of 484 to 556 gpm. The PUD will provide the recycled water to the Cogeneration Project via an existing 24-inch diameter pipe.

~~The Cogeneration Project would minimize water consumption by using an Air Cooled Condenser (ACC) instead of water intensive evaporative cooling systems. The Cogeneration Project is also evaluating the potential for reuse of industrial wastewater in an evaporative cooling system, although this alternative is not currently proposed. The proposed Cogeneration facility would require an additional 40 gpm of water for operation, which will be conveyed from the Refinery to the Cogeneration Project via an 8-inch diameter pipe.~~

Currently, the Cherry Point Refinery receives an average of 4,170 gallons per minute (gpm) of fresh water from the Whatcom County PUD. The total combined water consumption from the Whatcom County PUD during operation of the Refinery and Cogeneration facilities ~~will~~ would average ~~4,210~~ 6,414 to 6,486 gpm. ~~The ACC was selected to minimize the consumption of water~~. ~~The use of ACC instead of water intensive evaporative cooling systems requires higher capital expenditures and results in a lower net electrical output.~~

Hydrologic Regime

The existing Refinery and proposed Cogeneration Project site are located within the Terrell Creek drainage basin, which is characterized as having slightly undulating, but fairly flat terrain. Elevations within the site range from 100 feet above MSL to 120 feet above MSL, with the site sloping gently to the northwest, toward Terrell Creek.

Terrell Creek drains an irregular shaped section of the Mountain View Upland situated roughly between the settlement of Mountain View and Birch Bay. The size of the Terrell Creek drainage basin is approximately 17 square miles. This basin includes Terrell Lake, Terrell Creek, Butler Ditch, Fingalson Creek, and a couple of unnamed creeks/ditches.

Groundwater Regime

The location of the Cogeneration Project is the Mountain View Upland of the Whatcom Basin. The Mountain View upland is a low plateau area comprising about 42 square miles of land west of Ferndale, Washington to Strait of Georgia. The surface geology of the Mountain View upland consists mainly of Quaternary glacial marine deposits of the Bellingham Drift (Qb) with a surficial veneer of reworked Bellingham Drift sand and gravel locally present. The Mountain View upland topography is characterized by low rolling morainal hills with a maximum altitude of 385 feet above sea level. The relatively impermeable Bellingham Drift surface supports several swamps and Lake Terrell.

Hydrostratigraphic units align closely to the geologic units. The major water-bearing units are the predominately sand and gravel geologic strata. Aquifers are typically within the Deming Sand (Qd) and the Esperance Sand Members. The marine drifts of the Bellingham (Qb) and Kulshan (Qk) and glacial Vashon Till (Qvt) are typically aquitards that have low permeability are restricting groundwater flow. The Bellingham Drift aquitard is at or near the surface at the proposed site and the Deming Sand aquifer lies below this aquitard. The Deming Sand aquifer is the first encountered aquifer, but is not hydraulically connected to Terrell Creek. Groundwater flows horizontally toward the west to northwest within the Deming Sand and deeper aquifers beneath the proposed site. A downward hydraulic gradient exits through the Bellingham Drift aquitard.

The Bellingham Drift aquitard is laterally extensive and thick beneath the proposed site. This aquitard is expected to be an effective soil medium to absorb and retard the migration of accidental releases of contaminants to the subsurface environment. Many years would be necessary to have potentially impacted water migrate short distances. As a result, the low permeability soils layer within the vicinity of the Refinery and proposed Cogeneration Project will help to protect the underlying aquifers from potential contamination in the event of inadvertent chemical spills, leaks, or discharges during construction or operation of the Cogeneration Project.

The proposed Cogeneration Project will have no adverse impact on recharge to the groundwater systems. Recharge to the upper water-bearing zone is by direct rainfall precipitation and infiltration. The Deming Sand aquifer is recharged from distant hills and from leakage through the overlying Bellingham Drift aquitard.

Protection of Water Resources

For the construction of the Cogeneration Project, a Stormwater Pollution Prevention Plan (SWPPP) will be developed in accordance with "Best Management Practices" (BMPs) and will detail the sediment and erosion control measures and accidental spill prevention and control measures. The BMPs will be implemented, inspected, and maintained to minimize the potential for adversely affecting downstream water quality. These may include, but will not necessarily be limited to, such things as silt fencing and hay bales~~, and placement of polyethylene tarps~~ to cover exposed surfaces. Control of fuel storage and equipment fueling operations for spill prevention and control will be detailed in the SWPPP. These BMPs will be inspected after every storm event greater than 0.5 inches of precipitation in 24-hours to assess damage and maintenance requirements, if any.

During construction and operation, stormwater will be collected and routed initially to an oil/water separation system then to a detention pond for final treatment and detention as required by the project stormwater pollution prevention plan. The oil/water separation system will be able to control accidental releases of fuels, oils, and chemicals during construction and operation of the Cogeneration Project. The detention pond will allow stormwater to infiltrate or discharge to wetlands within the same hydrologic basin. There would be no adverse change to the returning quantity and quality of the collected stormwater to the Terrell Creek drainage basin. The NPDES permit applications for construction and operation of the Cogeneration facility are included as an attachment to this Technical Report. With the proposed stormwater treatment and detention system, it is anticipated that there will be no measurable impact on the surface water hydrological regime.

Potential contaminant sources would exist onsite during facility operations. Potential impacts to surface water and groundwater during operation of the proposed Cogeneration Project will be protected by the installation and maintenance of secondary containment facilities on all bulk chemicals stored and used on the site. The Cogeneration Project will utilize BMPs in compliance with applicable regulations for the transportation, handling, storage, and use of oils/greases, chemicals, and waters having undesirable constituents. Prior to operation of the Cogeneration Project, a Spill Prevention, Control and Countermeasures (SPCC) Plan will be developed and implemented that will detail measures to minimize the potential for an uncontrolled release to the environment.

During operation of the Cogeneration Project plant, the following wastewater streams will be discharged through BP's refinery wastewater treatment:

- ~~Spent boiler feedwater (BFW);~~
- ~~Blowdown water from the heat recovery steam generators (HRSGs); and~~
- Raw water treatment waste and Refinery return condensate treatment system waste;
- Collection of water and/or other minor drainage from various types of equipment; and~~Accumulated water from secondary containment areas and other minor drainage from various types of equipment;~~
- Cooling tower blowdown.

Sanitary wastes will be discharged to the Birch Bay Water and Sewer District's (District) treatment system in accordance with the terms and conditions of an Agreement between the Refinery and the District. The District has confirmed that it has the capacity to accommodate the incremental combined sewage loading from the Refinery and the proposed Cogeneration Project facility.

Stormwater will be controlled and detained during construction and operation of the Cogeneration Project using wet ponds, which provide both treatment and detention of stormwater. The ponds have been sized preliminarily using the Western Washington Hydrology Model version 2.

Water Supply

The PUD will supply water to the Cogeneration Project by recycling water used for non-contact once-through cooling at the nearby Alcoa aluminum smelter.

~~Water used for industrial purposes within the Cogeneration Plant would be supplied under the existing contract between the BP Refinery and Whatcom County Public Utility District (PUD). The PUD supplies this water from the Nooksack River under their certified surface water diversion rights.~~

Potable (treated) water used within the Cogeneration Plant would be provided by the District. The District currently purchases water from the City of Blaine according to Department of Health data. The City of Blaine water supply is received from groundwater sources under certified groundwater withdrawal rights.

Only a few existing surface water and groundwater rights are established in the vicinity of the Cogeneration Project. There are numerous wells in the aquifer to the north of the Refinery and proposed Cogeneration Project, east and south of Lake Terrell. These wells are primarily used for domestic and irrigation purposes and have yields ranging from tens of gallons per minute (gpm), to several hundred gpm. The Town of Ferndale holds the largest groundwater rights for municipal water supply in the area. There are no surface water rights identified for diversion from Terrell Creek nor were any applications for Terrell Creek water rights found. There are several groundwater right permit applications currently being reviewed by the state Department of Ecology. Any new groundwater rights, which are granted based on these applications, would need to be evaluated to determine their potential effect on surface water.

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LIST OF ACRONYMS

ASC	Application for Site Certification
BFW	boiler feedwater
BMP	Best Management Practices
BPA	Bonneville Power Administration
°C	degrees Celsius
Cogeneration Project	BP Cherry Point Cogeneration Project
EFSEC	Washington State Energy Facility Site Evaluation Council
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
gpd	gallons per day
gpm	gallons per minute
hr	hour
HRSG	heat recovery steam generator
JARPA	Joint Aquatic Resources Permit Application
L	liter
lb	pound
mg	milligram
mgpm	million gallons per minute
mL	milliliter
Mlb	million pounds
MSL	mean sea level
MW	megawatt
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity units
OWS	oil water sewer
PSS	Potential Site Study
PUD	Whatcom County Public Utility District

Qb	Bellingham Drift
Qbg	surfical sand and gravel
Qd	Deming Sand
SPCC	Spill Prevention, Control, and Countermeasures Plan
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control Plan
TMDL	Total Maximum Daily Load
USCS	Universal Soil Classification System
USLE	Universal Soil Loss Equation
WAC	Washington Administrative Code
WQS	water quality standard

1. INTRODUCTION

This technical report addresses the required information on Water for the BP Cherry Point Cogeneration Project (Cogeneration Project), as outlined within the Potential Site Study (PSS) issued by the Washington State Energy Facility Site Evaluation Council (EFSEC).

This technical report has two sections; water regarding the Natural Environment of the proposed facility location, and water regarding the Built Environment after the facility has been completed and is commissioned. Among other topics, stormwater management, water supply, and wastewater treatment are discussed. This report provides detailed information in support of the Application for Site Certification (ASC).

2. PROJECT DESCRIPTION

The proposed BP Cherry Point Cogeneration Project (Cogeneration Project) would be a combined cycle (steam and electricity) facility located at the BP Cherry Point Refinery (Refinery), which is near Ferndale and Blaine in northwestern Whatcom County, Washington. The proposed Cogeneration Project would use a state-of-the-art high-efficiency power generation system and use clean-burning natural gas as its main fuel. The plant would produce a nominal 720 megawatts (MW) and would be configured with three natural gas-fired combustion turbines each driving one electric generator. Each of the gas turbines would be equipped with a heat recovery system generator (HRSG) with duct-firing capability. Steam produced from the stream generators would be combined and sent to a single steam turbine-driven electric generator with steam extraction and condensing capability.

Cogeneration offers increased efficiencies that would not otherwise exist for electrical power generation. The Cogeneration Project would integrate its operation with the Refinery for increasing efficiency and reducing potential impacts to natural resources. The Cogeneration Project would supply steam and electricity to the Refinery, which would in turn recycle condensate back to the Cogeneration Project. Cogeneration would allow the Refinery to shut down older, less efficient boilers that are currently used for steam supply. The proposed Cogeneration Project would not use backup fuels. ~~The Cogeneration Project would minimize waste an Air Cooled Condenser instead of water intensive evaporative cooling systems~~ The ~~small amount of~~ wastewater (~~50~~190 gpm on average, assuming 15 cycles of concentration in the cooling tower) produced by the Cogeneration Project would be sent to the Refinery wastewater treatment system.

The Cogeneration Project would ~~minimize~~ reduce fresh water consumption by reusing ~~an Air Cooled Condenser (ACC) instead of water intensive evaporative cooling systems.~~once through cooling water from the nearby Alcoa aluminum smelter. The PUD will provide 2,780 gpm of recycled industrial cooling water on average. The Cogeneration Project would also reduce the Refinery's water demand by about 20 gpm by providing steam to the Refinery. ~~The Cogeneration Project is also evaluating the potential for reuse of industrial wastewater in an evaporative cooling system, although this alternative is not currently proposed. The proposed Cogeneration Project would~~ The result would be a decrease ~~in a net increase~~ in freshwater consumption of 484 to 556 gpm on average. ~~of 40 gpm of water. Freshwater~~ The PUD will convey industrial cooling water from Alcoa ~~will be conveyed~~ to the Cogeneration Project ~~from the Refinery~~ via an existing ~~8~~ 24-inch diameter pipe. Currently, the Cherry Point Refinery receives an average of 4,170 gallons per minute (gpm) of fresh water from the Whatcom County PUD. The total combined water consumption from the Whatcom County PUD during operation of the Refinery and Cogeneration facilities will average ~~4,210~~ 6,414 to 6,486 gpm. The use of recycled water in a conventional evaporative cooling system allows the Cogeneration Project to conserve water while enhancing the efficiency of the power plant. ~~The ACC was selected to minimize the consumption of water. The use of ACC instead of evaporative cooling systems requires higher capital expenditures and results in lower electrical output.~~

3. PROJECT SETTING

The entire project, including the Cogeneration plant and support facilities, the new transmission line, natural gas and water supply lines, and construction laydown areas would be on BP Refinery-owned property, immediately adjacent to the existing Refinery which has operated at this site since 1971. The Refinery and proposed Cogeneration Project site are contained within the Cherry Point Major Industrial Urban Growth Area/ Port Industrial Zone, as defined in the Whatcom County Comprehensive Plan. Other operational industries in the general vicinity of the proposed Cogeneration Project and Refinery include:

- Puget Sound Energy's Point Whitehorn Generating Plant, located approximately 1 mile to the west along Jackson Road;
- PRAXAIR Inc. carbon dioxide compression and transportation facility located approximately 0.75 miles south of the proposed Cogeneration Project site along Aldergrove Road; and
- Chemco's Wood Treating Plant located approximately 0.75 miles east of the proposed Cogeneration Project site along Grandview Road.

The entire project area is zoned Heavy Impact Industrial. The Cogeneration Project site will occupy approximately 33 acres of unimproved land immediately adjacent to the Refinery, which occupies approximately 450 acres (Figure 3.0-1). The total construction laydown and parking areas (Laydown Areas 1 through 4) and would occupy approximately 36 acres. Laydown Areas 1 through 4 are shown on Drawing AD-00-4300-00108 for Cogeneration Project. An optional construction laydown area, if needed, could be Laydown Area 5 (Drawing SK-BE7608-MD-0006). Some of the laydown areas are currently paved or graveled. Existing slopes range from 0.5% to 1%. Some drainage ditches exist along the side of Grandview Road, near the railroad, and in other locations where natural topography provides drainage.

The electrical transmission connection from the Cogeneration Project to the BPA Transmission Corridor is shown on Drawings AD-00-4300-00108 and Ad-00-4300-00109. The 150-foot wide electrical transmission line corridor has not yet been cleared of trees, although the access/maintenance roads leading to the transmission line corridor have been developed. Three pads for the transmission towers have already been constructed. The gravel pads are approximately 50 feet by 50 feet. An additional pad will be constructed at a later date adjacent to the BPA Transmission Corridor. There are two gravel access roads, approximately 15 feet wide, which have been developed for construction and access of the transmission pads and footings. These pads and access roads were constructed under an existing JARPA permit. The surrounding areas are undisturbed grassland and forest.

There are several access roads and paths that exist near or within the site boundaries. Blaine Road, which runs between the site and the laydown areas on BP owned property, is paved. A 15-foot wide gravel road intersects perpendicularly with Blaine Road and runs adjacent to the fence line, inside the Refinery boundaries.

Existing vegetation on the Cogeneration Project site and surrounding areas consists of grassland, young forest, and wetlands. The wetlands are attributed to poor drainage because of the relatively low topographic gradient and the underlying low permeability glacial drift stratum consisting of clays and silts below the soil horizon.

The following provides a description of the existing and natural surface water runoff and groundwater characteristics (quantity and quality), as well as a description of potential impacts to surface water resources associated with the construction of the proposed Cogeneration Project.

4. NATURAL ENVIRONMENT

4.1 Surface Water

The existing Refinery and proposed Cogeneration Project site are located within the Terrell Creek drainage basin, which is characterized as having slightly undulating, but fairly flat terrain. Elevations within the site range from 100 feet above MSL to 120 feet above MSL, with the site sloping gently to the northwest, toward Terrell Creek. Figure 4.1-1 depicts the Terrell Creek Basin, which eventually discharges into Birch Bay of the Strait of Georgia.

Terrell Creek drains an irregularly shaped section of the Mountain View Upland between the settlement of Mountain View and Birch Bay and is the only significant surface water feature within one-half mile of the proposed Cogeneration Project site. The size of the Terrell Creek drainage basin is approximately 17 square miles. This basin includes Terrell Lake, Terrell Creek, Butler Ditch, Fingalson Creek, and a couple of unnamed creeks/ditches. Terrell Creek does not and has not had a consistent stream flow gage.

Terrell Creek is an 8.7-mile long third order stream. The headwater of this creek is Terrell Lake. From the lake, the stream meanders in a northwesterly direction, and after two miles is joined by Fingalson Creek from the east. Shortly thereafter, the mainstem turns west and flows as far as Point Whitehorn Road on the shore of Birch Bay. All stream flow is derived from surface runoff and baseflow is practically non-existent. Terrell Creek reportedly dries up normally during August and September of each year (State of Washington Department of Conservation 1960).

Terrell Creek was surveyed by URS Corporation (2001) for the purposes of impact evaluation and mitigation potential on June 20-21, 2001 and June 27-28, 2001. The channel dimensions, riparian vegetation, and in-stream conditions change significantly across this length. From the railroad tracks to approximately mid-way between Blaine Road and Jackson Road, the stream has a 0.5 to 2 percent gradient, a cobble and gravel substrate, and deep shading by mature riparian forest. Channel width ranges between 3 to 8 feet. The floodplain is narrow (2 to 10 feet from the bank) in most locations, but appeared to contain some wetland areas. Water was flowing at 0.2 to1.5 feet per second (fps) and was 2 to 7 inches in depth at the time of a survey. An estimated discharge rate was approximately 1.5 cubic feet per second (cfs). This portion of the stream has excellent water clarity and flows over a coarse substrate suitable for aquatic flora and fauna adapted to lotic conditions.

4.1.1 Existing Stormwater Runoff Conditions

Whatcom County receives an average of 40.7 inches of precipitation annually (Goldin, 1992). Stormwater runoff from the existing Refinery and proposed Cogeneration Project site drains indirectly into Terrell Creek through surface drainage watercourses which flow under Grandview Road through culverts, which discharge into constructed wetland ponds north of Grandview Road. Drainage ditches exist along Blaine Road, Grandview Road, between laydown areas, and through the middle of the proposed site. A few natural drainages also exist due to topography (see Figure 4.1-2). All ditches eventually drain into Terrell Creek, which is located within BP's habitat mitigation and enhancement area north of Grandview Road, approximately 0.5 miles from the proposed Cogeneration Project site.

For stormwater runoff rates and quantity during construction and operational activities of the plant site, please see Attachment A, *"Surface Water Management System Design Basis,"* and supplemental technical memoranda prepared by Golder Associates, (December 20, 2001 and March 2003). This report and supplemental technical memoranda ~~identifies~~ identify the statistical storm intensities, anticipated quantity of stormwater during the construction and operation of the Cogeneration Project and present~~s~~ the proposed stormwater collection and treatment system.

The quality of the stormwater during construction and/or operation of the Cogeneration plant will be controlled and treated for discharge to the natural environment. During construction, sediment and erosion control measures will be implemented to control the quality and volume of stormwater runoff such that it complies with regulatory standards. Stormwater will be routed through engineered detention ponds designed to maintain turbidity levels of discharge water to be less than ~~50~~ 5 NTU (Nephelometric turbidity units) over background turbidity if background is 50 NTU or less, or be less than 10 percent above background turbidity when background is greater than 50 NTU. Runoff from undisturbed areas will remain in the natural condition, with a relatively low turbidity.

Runoff quantities from the water supply and distribution lines and along the transmission line corridor during construction and operation will be approximately the same as the natural (existing) conditions, due to a negligible amount of newly created impervious areas. The access roads and pads for three of the transmission towers are gravel surfaced and have already been constructed, under an existing JARPA permit. The area surrounding each footing/pad remains in the natural condition.
Runoff from operational areas within the plant site will be within required limits after treatment. Runoff from surfaces, which potentially may be impacted by grease or oil, will be treated using an oil/water separation system and a wetpond for additional treatment and detention. Oil and grease concentrations will be less than ~~10~~ 15 mg/L, and turbidity will be less than ~~50~~ 5 NTU over background turbidity if background is 50 NTU or less, or be less than 10 percent above background turbidity when background is greater than 50 NTU.

4.1.2 Ambient Water Quality

Information on water quality of Terrell Creek was not found in the literature. State Water Quality Classifications are found in Chapter 173-201a of the Washington Administrative Code (WAC). There are no specific classifications for Terrell Creek or Terrell Lake. Therefore, both fall under Chapter WAC 173-201A-120 general classifications and are classified as "Class AA, ~~excellent~~ extraordinary waters". Class AA waters have the following characteristic uses.

- Water Supply (domestic, industrial, agricultural);
- Stock Watering;
- Fish and Shellfish: Salmonid migration, rearing, spawning, and harvesting. Other fish migration, rearing, spawning, and harvesting. Clam, oyster, and

mussel rearing, spawning, and harvesting. Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting;

- Wildlife habitat;
- Recreation (primary contact recreation, sport fishing, boating and aesthetic enjoyment); and
- Commerce and navigation.

Class AA waters must meet the following water quality criteria as found in Chapter 173-201A – 030.

- **Fecal Coliform** – expressed as number of colonies per ~~100~~ 50 mL, the geometric mean shall be less than 100 with less than 10% of samples exceeding ~~200~~100.
- **Dissolved Oxygen** – shall exceed ~~8.0~~ 9.5mg/L.
- **Temperature** – Temperature shall not exceed ~~18~~ 16 º C due to human activities. When natural conditions exceed ~~18~~ 16º C no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3 º C; nor shall such temperature increases, at any time, exceed t=~~28~~23/(T + ~~9~~5). (Where t = maximum permissible temperature increase measured at the mixing zone boundary; and T = the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge).
- **pH** – shall be within a range of 6.5 to 8.5 with a human-caused variation within the above ranges of less than ~~0.5~~0.2 units.
- **Turbidity** – shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
  - **Toxic Material** – standards vary based on the contaminant and can be found in Chapter 173-201A-040 WAC.
  - **Radioactive Material** – concentrations shall be the lowest practicable concentration attainable and in no case shall exceed
    - 1/12.5 of the values listed in Chapter 246-221-290 WAC
    - USEPA Drinking Water Regulations for radionuclides
- **Aesthetics** – shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.
- **Metals** – concentrations vary with other river parameters, standards for metals of concern in the study area are calculated based on hardness.
- Dissolved Cadmium

  Chronic < (1.101672-((ln(hardness))*(0.041838)))*EXP(0.7852*(ln(hardness))-3.49)

Acute < (1.136672-((ln(hardness))*(0.041838)))*EXP(1.128*(ln(hardness))-3.828)

- Dissolved Lead

  Chronic < (1.46203-((ln(hardness))*(0.145712)))*EXP(1.273*(ln(hardness))-4.705)

  Acute < (1.46203-((ln(hardness))*(0.145712)))*EXP(1.273*(ln(hardness))-1.46)

- Dissolved Zinc

  Chronic < 0.986*EXP(0.8473*(ln(hardness))+0.7614)

  Acute < 0.978*EXP(0.8473*(ln(hardness))+0.8604)

Neither Terrell Creek nor Terrell Lake are included on the Department of Ecology's (Ecology) section 303(d) list of impaired waters. There are no Total Maximum Daily Load (TMDL) plans established for these waters nor are they subject to any other existing water quality limitation. Water quality complaints have been received by Ecology regarding Terrell Creek. Water quality problems include bad smell, color, sheen, and temperature. Monitoring data to substantiate these complaints could not be found. No standards or other parameters are at risk from the proposed power plant, water pipelines, natural gas pipeline connections, and transmission lines.

4.1.3 Sediment and Erosion Potential

The general soil units that encompasses most of the proposed Cogeneration Project site and vicinity is the Birchbay-Whitehorn units (Goldin, 1992). Elements of the Whatcom-Labounty unit and the Kickerville-Barneston-Everett unit are also present in the vicinity. A description of the unit soils are given below:

- **Birch Bay silt loam (0 to 3 percent slopes)** - This soil type encompasses the northern portion of the proposed Cogeneration Project site. This very deep, moderately well drained soil is on wave-reworked glaciomarine drift plains. It formed in an admixture of volcanic ash and loess over glaciofluvial deposits and glaciomarine drift. Permeability is moderate in the upper part, very rapid in the sandy upper part of the substratum, and slow in the loamy lower part. Available water capacity is high. Runoff is very slow and there is no hazard of erosion.

- **Whitehorn silt loam (0 to 2 percent slopes)** – This soil type encompasses most of the proposed Cogeneration Project site. This very deep, poorly drained soil is in depressions on glaciomarine drift plains. It formed in glaciomarine drift with an admixture of loess and volcanic ash. Permeability is moderately slow and available water capacity is high. Runoff is very slow and there is no hazard of erosion.

- **Kickerville silt loam (0 to 3 percent slopes)** - This soil type is found on a low hill north of the proposed Cogeneration Project site north of Grandview Road. This very deep, well-drained soil is on outwash terraces. It formed in a mixture of loess and volcanic ash over glacial outwash. Permeability is moderate in the upper part and very rapid in the substratum. Available water capacity is high. Runoff is very slow and there is no hazard of erosion.

- **Labounty silt loam (0 to 2 percent slopes)** - This soil type encompasses the eastern portion of the proposed Cogeneration Project site. This very deep, poorly drained soil is on wave-reworked glaciomarine drift plains. It formed in volcanic ash, loess, glaciofluvial deposits, and glaciomarine drift. Permeability is slow and available water capacity is high. Runoff is very slow, and so the soil may be ponded during the winter and spring. There is no hazard of erosion.

All soil at and in the vicinity of the proposed Cogeneration Project site is described as presenting no hazard of erosion (Goldin, 1992). Quantitatively the erosion susceptibility of a given soil type to sheet and rill erosion due to agricultural practices can be described using the erosion factor K. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

The following is a list of erosion factors for the soils located at and in the vicinity of the proposed Cogeneration Project site (Grodin, 1992):

Soil Type	Depth (in.)	K Factor
Birch Bay (12)	0-8	0.32
	8-24	0.24
	24-42	0.10
	42-60	0.28
Whitehorn (184)	0-10	0.37
	10-18	0.49
	18-26	0.24
	26-60	0.49
Labounty (93)	0-12	0.32
	12-29	0.32
	29-37	0.37
Whitehorn (184)	0-10	0.37
	10-19	0.49
	18-27	0.24
	26-60	0.49

Soils within the area consist primarily of clays and silts, which are characterized, as moderately well drained to poorly drained (Goldin, 1992). The soils in the vicinity of the Cogeneration Project site are described as presenting no hazard of erosion (see Part III, Appendix G: Technical Report on Earth for more details), because of the relatively flat gradient and grassed vegetative cover. Stormwater runoff is not substantial, and currently does not lead to naturally elevated levels of sediment discharges and erosion impacts. Land cleared of vegetation for construction increases the potential for erosion to occur.

During construction of the Cogeneration plant, “Best Management Practices”(BMPs) for sediment and erosion control (prevention) will be implemented, inspected, and maintained to minimize the potential for adversely affecting downstream water quality. These may include, but will not necessarily be limited to, such things as silt fencing, sand bagging~~,~~ and hay bales~~, and placement of polyethylene tarps~~ to cover exposed surfaces. These BMPs will be inspected after every storm event greater than 0.5 inches of precipitation in 24-hours to assess damage and maintenance requirements, if any. Stormwater runoff from the construction site will be routed to a stormwater treatment and detention system (see Section 5.5 for more details).

4.1.4 Stream Crossings

There are no new surface water crossings associated with access roads, natural gas pipeline connections, water supply pipeline connections, and transmission line. Consequently, instream work for Cogeneration Project construction will not be necessary, therefore construction activities will not be restricted by specific flows requirements of nearby streams.

4.1.5 Flood Hazard Potential

Based on a review of Federal Emergency Management Agency (FEMA) maps of the Whatcom County area, the Cogeneration Project and all associated components are located outside of the 5-, 100-, and 500-year floodplain. This assessment is based on a review of the following FEMA maps:

- City of Bellingham, Washington, Whatcom County, Panels 1-10 (effective date: September 2, 1982);
- City of Blaine, Washington, Whatcom County, 1 panel only (effective date: July 16, 1979);
- City of Everson, Washington, Whatcom County, 1 panel only (effective date: August 2, 1982);
- Town of Ferndale, Washington, Whatcom County, 1 panel only (effective date: June 1, 1983);
- City of Lynden, Washington, Whatcom County, 1 panel only (effective date: November 3, 1982);
- City of Nooksack, Washington, Whatcom County, 1 panel only (effective date: September 2, 1982); and
- City of Sumas, Washington, Whatcom County, 1 panel only (effective date: May 15, 1985).

Figure 4.1-3 depicts the limits of the 5-year, 100-year, and 500-year floodplains, which demonstrate that the Cogeneration Project site is outside of these limits. Therefore, construction-related mitigation requirements for potential flooding are not necessary.

4.2 Groundwater

This section provides an overview of the groundwater regime within the vicinity of the proposed Cogeneration Project, including regional and local hydrostratigraphy, groundwater recharge characteristics, groundwater quality, aquifer characteristics, soils characteristics, and licensed well users. Based on an assessment of the groundwater and soils regime, there is negligible risk of impact for the construction and operation of the Cogeneration Project to effect groundwater quality and quantity.

4.2.1 Regional Geologic Hydrostratigraphy

The location of the Cogeneration Project is the Mountain View Upland of the Whatcom Basin (Newcomb, *et al.* 1949). The Mountain View upland a low plateau area comprising about 42 square miles of land west of Ferndale, Washington to Strait of Georgia. The surface geology of the Mountain View upland is illustrated in Figure 4.2-1 (Easterbrook 1976) and consists mainly of Quaternary glacial marine deposits of the Bellingham Drift (Qb) with a surficial veneer of reworked Bellingham Drift sand and gravel locally present. The Mountain View upland topography is characterized by low rolling morainal hills with a maximum altitude of 385 feet above sea level. The relatively impermeable Bellingham Drift surface supports several swamps and Lake Terrell.

The geologic stratigraphy typically encountered in the Mountain View upland area is provided in Table 4.2-1 (Easterbrook 1976). Borehole/well logs in the vicinity of the Cogeneration Project are provided in Part III, Appendix G – Technical Report on Earth and indicate the stratigraphic sequences to be present in the Mountain View upland area. Figure 4.2-2 shows borehole/well locations and Figures 4.2-3 through 4.2-6 illustrates the geologic cross sections indicated by these borehole/well logs. The unconsolidated strata in the area represent materials mainly deposited during the Everson Interstade and the Vashon Stade during the Pleistocene. Along the shoreline and Terrell Creek mouth a more recent Sumas Interstade surface deposit (Terrace Deposits–Qt) is present. In deeper horizons, undifferentiated Quaternary deposits exist that are possibly of earlier glacial/marine origins. Undifferentiated sandstone bedrock was encountered about two miles northeast and north of the Cogeneration Project at depths over 200 feet, but was not found in boreholes closer to the Cogeneration Project to depths of 650 feet. A more detailed description of the geology of the Cogeneration Project area is located in Part III, Appendix G – Technical Report on Earth.

Hydrostratigraphic units are defined in Table 4.2-1 and align closely to the geologic units. The major water-bearing units are the predominately sand and gravel geologic strata. Aquifers are typically within the Deming Sand (Qd) and the Esperance Sand Members. The marine drifts of the Bellingham (Qb) and Kulshan (Qk) and glacial Vashon Till (Qvt) are typically aquitards that have low permeability are restricting groundwater flow. These marine drifts can locally contain elevated sand and gravel content, but have sufficient silt and clay content to have very low permeabilities. Although the marine drifts and glacial tills could contain sand and gravel lens, the extent of such lenses is typically limited and does not yield significant quantities of water.

Detailed hydrogeologic studies at the Refinery have discovered the upper portion of the Bellingham Drift to be weathered to depths of 20 feet and is more permeable than the lower unweathered portions of this Member. The surficial sand and gravel (Qbg) and weathered Bellingham Drift together comprise the uppermost water-bearing zone in the hydrostatigraphic sequence.

4.2.2 BP Cherry Point Cogeneration Project Hydrostratigraphy

The hydrostratigraphy described in the Mountain View upland area above is anticipated to represent the units underlying the Cogeneration Project. Although many hydrogeologic investigations were conducted at the BP Cherry Point Refinery, there is no record of any boreholes or wells placed within the Cogeneration Project site location. The closest monitoring well being MW1, which was located in the southwest corner of the intersection of Grandview Road and Blaine Road on BP property. Monitoring well MW1 was abandoned in 1982. Recently, exploration boreholes were drilled for geotechnical considerations in preparation for the electrical transmission line corridor and towers. Boreholes B-2 and B-3 were placed south of the proposed Cogeneration Project (Shannon and Wilson, 1999). Figure 4.2-7 identifies the location of monitoring wells and piezometers used in hydrogeologic investigations at the Refinery and boreholes used for geotechnical investigations in preparation of the electrical corridor. None of the monitoring wells piezometers and boreholes penetrated more than 110 feet. Hydrogeologic investigations focused on the surficial Sand and Gravel (Qbg), the weathered and unweathered Bellingham Drift (Qb) and the uppermost portion of the Deming Sand (Qd) hydrostatigraphic units. Today, all monitoring wells in the Deming Sand (Qd) aquifer have been abandoned in 1982 to eliminate potential avenues for groundwater migration from the upper water-bearing zone to the underlying Deming Sand aquifer. Nested piezometers having monitored intervals in the Deming Sand aquifer also have been abandoned during the 1990's. Therefore, little recent data exists with respect to the Deming Sand aquifer properties.

The Refinery has never had a water supply well. It receives supply water from the Whatcom PUD. Water supply wells (39/01-05 E and ABP 576) were drilled about 0.5 miles north and 0.75 miles south of the Cogeneration Project site location, respectively (see Figure 4.2-2). The hydrostratigraphic units reported in the borehole logs represented the anticipated and typical geologic sequences in the Mountain View area. Both borehole logs did not indicate bedrock was encountered. Well 39/01-05 E was drilled to a depth of 700 feet without indication of encountering bedrock.

Although geologic and hydrogeologic investigations or data do not exist specifically for the Cogeneration Project site location, the geology, and hydrostratigraphy illustrated in Figures 4.2-3 through 4.2-6 are representative of anticipated conditions and unit depths underneath the Cogeneration Project site.

4.2.3 Groundwater Movement

Groundwater movements within the Whatcom Basin have been reported in Newcomb, *et al.* (1949) and Easterbrook (1973). The reports do not provide groundwater movement in specific aquifers, but instead, are referred to as "water table contours on top of essentially common water body." Generalized contours of the surface of the water table are shown on Figure 4.2-8. These contours represent horizontal potentiometric gradient in the groundwater system. Groundwater flow is perpendicular to the gradient and is indicated by the flow arrows in Figure 4.2-8. The groundwater in the water table generally is flowing toward the west across the Cogeneration Project site.

Although many groundwater level measurements were obtained from numerous hydrogeologic studies at the Refinery, the studies focused on individual waste management units that were not studied at the same time or years. The horizontal potentiometric gradient within the upper water-bearing zone of the surficial Sands and Gravels (Qbg) and the weathered Bellingham Drift (Qb) beneath the Refinery are presented in Figure 4.2-9. The hydraulic gradient shown in Figure 4.2-9 is approximate, because the water level measurements were obtained during the fall, but not the same year from different waste management unit studies. In general, the groundwater flow is consistent with observations at the waste management unit studies (see Attachment B) and the horizontal potentiometric gradient presented in Figure 4.2-8 for the area. Groundwater flow is northwest across most of the Refinery toward Strait of Georgia. An exception occurs in the southeastern portion of the Refinery where a groundwater divide is indicated from the data. Groundwater in the upper water-bearing zone has more of a westerly flow direction in the southeastern portion of the Refinery. Horizontal potentiometric gradients in the upper water-bearing zone vary from approximately 0.003 to 0.009 in the southeast portion of the Refinery to 0.01 to 0.05 in the northwest portion of the Refinery (Remediation Technologies, Inc. 1993).

CH2M HILL (1985) has studied the Deming Sand (Qd) aquifer. The horizontal potentiometric gradient and flow was found to be also towards the northwest. The horizontal potentiometric gradient was estimated to be 0.015 in this aquifer (CH2M Hill 1985).

Hydrogeologic studies conducted detailed measurements of water levels in nested piezometers (monitoring multiple depths at a single location) to determine vertical potentiometric gradients to the Deming Sand (Qd) aquifer. These measurements are provided in graphical illustrations in Attachment C. The vertical potentiometric gradient was always downward from the upper water-bearing unit (Qbg and weathered Qb) and the unweathered Bellingham Drift to the Deming Sand (Qd) aquifer and ranged between 0.53 to 0.65. Vertical gradients within the upper water-bearing zone and the unweathered Bellingham Drift was complex a may be dependent on season or even precipitation events.

4.2.4 Groundwater Recharge and Discharge

The Deming Sand (Qd) aquifer is likely recharged via local precipitation over elevated areas such as Holman Hill located about 2 miles east of the Cogeneration Project. Recharge also occurs over a broad area to the Deming Sand aquifer via infiltration through the Bellingham Drift. Although the Bellingham Drift is an aquitard, leakage through this unit over large areas does provide recharge. Discharge from the Deming Sand is likely to the lower reaches of tributary drainages near sea level or to Strait of Georgia depending on the location and configuration of the aquifer.

The older and deeper Vashon and pre-Vashon aquifers are likely part of a regional groundwater flow system within the overall Whatcom Basin. Recharge likely occurs inland, possibly on the higher elevation fringes of the basin. Groundwater in the Vashon and older aquifer systems discharge offshore to the Strait of Georgia.

4.2.5 Groundwater Interaction with Surface Water

Groundwater in the upper water-bearing zone is in hydraulic continuity with the local streams, namely Terrell Creek. Pumping surficial wells results in the capture of groundwater that would contribute to surface water flows. Wells completed in deeper aquifers (such as the Deming Sand and Vashon deposits) would have much less impact on surface water. The Deming Sand is found beneath 50 to over 70 feet of low-permeability Bellingham Drift. Water levels in wells in the Deming Sand aquifer are often in excess of 50 feet below ground surface. This means that Terrell Creek is effectively isolated (perched) from the Deming Sand, Vashon, and pre-Vashon aquifers at the Cogeneration Project location. Impacts from pumping wells completed in the Deming Sand aquifer would be felt downgradient, near the groundwater discharge point for the aquifer. Deeper wells in the Vashon and pre-Vashon deposits would not impact surface water because they would capture groundwater that discharges offshore to Strait of Georgia.

4.2.6 Aquifer Characteristics

Primary aquifer parameters described in this section include porosity and hydraulic conductivity. Tests conducted on soil samples for porosity measurements are provided in Attachment D. Porosity measurements in the Bellingham Drift range from 0.33 to 0.50. This unit is classified as either a CL or ML using the Unified Soil Classification System (USCS) which is described as an inorganic clay of low to medium plasticity including silty and sandy clays and as an inorganic silt in composition from clayey to very fine sandy silts, respectively (Remediation Technologies, Inc. 1993). The Deming sand has been described as silty sand-to-sand and gravel unit. Porosity is anticipated to total between 0.25 and 0.35 with and effective porosity for water transmission of about 0.2 to 0.25.

The hydraulic conductivities of the weathered and unweathered portions of the Bellingham Drift have been estimated using slug tests and laboratory falling head tests (Remediation Technologies, Inc 1993). The results of these tests are provided in Attachment E. Hydraulic conductivities ranged from 5.2 E–4 to 1.2 E-8 cm/sec in the weathered Bellingham Drift and 7.7 E-6 to 1.7 E-8 cm/sec in the unweathered Bellingham Drift. Only a few hydraulic tests were conducted in wells connected to the Deming Sand aquifer and the results indicate hydraulic conductivities from 5.7 E-5 to 3.8 E-8 cm/sec. The results for the Deming Sand aquifer may be low because the wells partially penetrated this unit only a few feet. An earlier estimate of hydraulic conductivity for the Deming Sand aquifer was 5 E-3 to 5E-4 cm/sec based on grain size descriptions (CH2M HILL 1983).

Groundwater average linear horizontal velocities in the weathered Bellingham Drift unit were estimated to be between 0.1 and 0.8 ft/yr (Remediation Technologies, Inc. 1993). Groundwater average linear horizontal velocity) in the Deming Sand aquifer have been estimated to be 25 to 260 ft/yr (CH2M HILL 1985).

4.2.7 Groundwater Quality

Groundwater quality within the Whatcom Basin typically has low dissolved solid content and is usable for domestic and public water supply. The salinity of the sand and gravel aquifers in the Mountain View upland area is low (generally blow 20 ppm of chloride). Reports indicate that the deeper pre-Vashon sediments contain water of good quality even from strata hundreds of feet below sea level (Newcomb, et al. 1949) the area. A 650 feet deep borehole log of a well (39-1w-13R) located west of the Refinery reported encountering groundwater of usable quality, while the borehole log (>600 feet depth) of the closest well (39/01-05 E) north of the Cogeneration Project site reported encountering groundwater with 500 ppm chloride content. Groundwaters in Tertiary bedrock commonly contain elevated salinity levels when encountered. Borehole log for well 40/1E/34 N well located about 2miles northeast of the Cogeneration Project site reported salty groundwater and encountered bedrock at just over 200 feet depth.

The most objectionable constituent in basin groundwater in the western Whatcom Basin is elevated iron (Newcomb, *et al.* 1949). Its occurrence is confined almost entirely to recessional outwash sands and gravels and recent alluvial deposits. A borehole log of well 40/1E-33 G reports a "sulfur smell " odor, possibly hydrogen sulfide. Such occurrence may be due to peat or swamp deposits in close proximity to the aquifer (Newcomb, *et al.* 1949).

There is no indication that groundwater at the Cogeneration Project site is contaminated. The low permeability and high retardation of the unweathered Bellingham Drift (Qb) is an effective barrier to sources of contaminants to the underlying Deming Sand (Qd) aquifer.

4.2.8 Groundwater Resources

Based on regional groundwater studies, two principal aquifers are recognized near the Cogeneration Project site:

- Medium to coarse sand with some layers of clay, silt and gravel of the Deming Sand. This aquifer is found at elevations ranging between –100 and +100 feet and ranges in thickness from a few feet to over 100 feet, and
- Sand and gravel associated with Vashon and pre-Vashon glacial outwash. This aquifer or series of thin water bearing zones is found generally below an elevation of 0 to –200 feet amsl to as deep as –600 feet amsl elevation. The thickness of the units is uncertain and may reach up to 50 feet.

There are numerous wells in the Deming Sand aquifer to the north, east and south of Lake Terrell. These wells are primarily used for domestic and irrigation purposes and have yields ranging from tens of gallons per minute (gpm), to several hundred gpm. The static water levels in these wells are often in excess of 100 feet below surface. Some wells within the western Mountain View upland area did not encounter adequate groundwater yields for use (Newcomb, et al. 1949).

Trillium Corporation recently drilled and tested a deep well (depth 1,320 feet) located about 0.5 miles west of the refinery. The well encountered some water bearing zones including a gravelly sand and gravel between 397 and 548. The well was screened in a gravel cobble and sand zone at a depth of 187 to 197 feet bgs. The well produced about 100 gpm of groundwater with 60 feet of drawdown in water level.

There are only a few deep wells in the vicinity of the site. The deepest operational water supply well near the Cogeneration Project, that Golder is aware, was drilled by the City of Blaine. This well reached a depth of about 830 feet and produces over 600 gpm from a sand and gravel aquifer in pre-Vashon sediments.

On June 19, 2001, Ecology's files were examined for water right applications. The PUD application file included a map showing the proposed well location just north of

Aldergrove Road and just west of Terrell Creek. Ecology correspondence included a preliminary permit dated July 2, 1997 to drill and test a 6-inch test well. Correspondence from the Lummi Tribe dated November 1, 1996 included a letter of protest. Golder was unable to determine if the test well had been drilled by the Whatcom County PUD.

The Trillium application file included a request from Ecology for more information concerning the well. Golder believes that a well was drilled between August and October 1996 to evaluate groundwater supply. There is no documentation in the Ecology file that a well was ever drilled or tested for Trillium.

4.2.9 Properties of the Substrate

The substrate beneath the Cogeneration Project consists of the surficial Sand and Gravel (Qbg) and the Bellingham Drift (Qb). This surficial Sand and Gravel unit has been observed at the Refinery and consists of primarily sand, ranging from a well-sorted sand to a silty sand/sandy silt. The clay content averages over 10 percent. Little to trace gravel has been observed locally. The thickness of the surficial Sand and Gravel unit varies from 0 (not present) to 9.5 feet (Remediation Technologies, Inc. 1993). Hydraulic conductivity tests have not been conducted within this unit, but are anticipated to be similar to the weathered Bellingham Drift. This unit is believed to have been derived from the reworking of the Bellingham Drift by wave action were some of the finer sediments have been removed from the original drift deposit Newcomb, *et al.* 1949).

The Bellingham Drift unit is weathered in the upper portion of the unit and unweathered to its base. The total thickness of the Bellingham Drift was observed to vary between 40 to over 70 feet at the BP Refinery and near the Cogeneration Project (Shannon and Wilson, 1999). The weathered Bellingham Drift is characterized by brown silty to sandy/pebbly clays and silts with subvertical and subhorizontal partings or by gray clays with red and brown staining along parting surfaces. Silt content ranges between 38 and 50 percent, while clay contents were measured between 35 and 57 percent in this unit. The weathered Bellingham Drift ranges in thickness from a few feet to 23 feet maximum. The hydraulic conductivity varies widely within the unweathered Bellingham Drift between 2 E-4 to 1 E-7 cm/sec (Remediation Technologies, Inc. 1993).

The unweathered Bellingham Drift is a massive, soft to moderately stiff and plastic gray silty clay and clayey silt with varying amounts of sand and pebbles. Its thickness varies from 18 to over 70 feet. The hydraulic conductivity of the unweathered Bellingham Drift averaged about 1 E-7 cm/sec and did not vary much between field slug testing and laboratory testing of vertical hydraulic conductivity (Remediation Technologies, Inc. 1993). The unweathered Bellingham Drift is an effective barrier to groundwater migration from the above water-bearing zones to the underlying Deming Sand (Qd) aquifer. This unit has a measured silt content of between 44 and 50 percent and a clay content of between 22.5 and 47 percent (Remediation Technologies, Inc. 1993). The resistance for water to vertically migrate to underlying aquifers is evident in the numerous perched wetlands, swamps, Terrell Lake and Terrell Creek in the vicinity of the Cogeneration Project (Newcomb, et al. 1949) and may be considered an aquiclude under less contemporary definitions.

4.2.10 Contaminant Subsurface Migration Potential

The Bellingham Drift is expected to be an effective soil medium to absorb and retard the migration of accidental releases of contaminants to the subsurface environment. Media specific characteristics that influence the migration of contaminants are liquid (impacted water or non-aqueous liquids) transmissive properties and the geochemical reactive properties with the contaminants. The weathered Bellingham Drift is capable of transmitting potentially impacted water or liquids horizontally in places where its hydraulic conductivity and potentiometric gradient is greatest. Groundwater flow velocities in this unit were estimated to be less than 1 ft/yr in most areas beneath the Refinery (Remediation Technologies, Inc. 1993). The unweathered Bellingham Drift restricts vertical migration of potentially impacted groundwater to underlying aquifer systems because of its low hydraulic conductivity. Using the observed vertical potentiometric gradient and the measured permeabilities and assuming and effective porosity of 0.15 for the unweathered Bellingham Drift results in a vertical migration velocity of less than a 0.5 ft/yr. It would take many years for potentially impacted water to migrate short distances. The vertical migration of non-aqueous liquids that are less dense than water would be halted by the surface of the water table within the upper water-bearing units. Non-aqueous liquids that are denser then water would have their vertical migration restricted by the transmissive properties of the unweathered Bellingham Drift unit.

Contaminant migration in geologic media is not only dependent on the fluid transmissive capabilities of the media. Geochemical properties of geologic media can react with contaminants and restrict or prevent contaminant migration. Most metals have increasing soil/water partitioning coefficients (soil adsorption of cations) with decreasing grain size of soil matrix. Clay minerals and particles have typically very high adsorption of metals because of their high cation exchange capacities and surface charges per mass. Although the soil/water-partitioning coefficient is specific to particular metal cations and the medium, the high silt and clay content of the weathered and unweathered Bellingham Drift media is expected to result in high soil/water partitioning coefficients with most potential metal contaminants. These substrate media could retard metal cation migration in the subsurface by an order-of-magnitude or more relative to the movement of water.

The soil/water partitioning coefficient for organic contaminants depends primarily on the organic carbon content of the media, which adsorbs and absorbs organic compounds and retards their migration in the subsurface environment. The Bellingham Drift unit is a glacial marine deposit and is characterized by abundant marine shell fragments indicative of marine life. Although the marine shell fragments contain inorganic forms of carbon, the marine sediments are anticipated to contain relatively good amounts of organic carbon as remnants of sea biomass in the deposited sediments. A Bellingham Drift Sample was analyzed to contain 2.8 percent organic carbon, which is similar to organic carbon content estimated by others for lake sediments (CH2M Hill 1985) Organic carbon contents of greater than 1.0 percent by weight can result in significant retardation of organic contaminant migration relative to water depending on the specific organic compound released.

Overall, the substrate to the proposed Cogeneration Project is effective at containing potential releases of contaminants to the subsurface environment. The substrates not only restrict the movement of water and liquids in general, but also have geochemical characteristics that will adsorb and retard potential releases of contaminants from the proposed Cogeneration Project.

4.2.11 Potential Impacts To Groundwater Recharge

The proposed Cogeneration Project will have no adverse impact on recharge to the groundwater systems. Recharge to the upper water-bearing zone is by direct rainfall precipitation and infiltration. The water levels in upper water-bearing zone are shallow (< 5ft depths at many locations) and are best described as perched groundwater in hydrologic continuity with the surrounding wetlands. Stormwater collected on the Cogeneration Project site will be routed to an unlined surface detention pond and allowed to infiltrate or discharge to wetlands within the same basin (see Attachment A for a more detailed description of the proposed stormwater control and quality system for the Cogeneration Project). The net effect would be returning the collected stormwater to the same hydrologic system for recharge. Stormwater, that accumulates within outside storage tank containment structures, is less than 5 percent of the entire stormwater to the proposed Cogeneration Project site (33 acres) and is the only stormwater that will not be returned to the same hydrologic basin. Because of potential impacts to capture stormwater within containment structures, this stormwater will be diverted and sent directly to the Refinery wastewater treatment system for eventual discharge to the Strait of Georgia. This diverted stormwater represents less than 0.02 percent of total stormwater to the basin, which is about 10,000 acres (17 square miles).

Recharge to the Deming Sand Aquifer will not be affected by stormwater control for the Cogeneration Project. The Deming Sand aquifer is recharged from distant hills and from leakage through the overlying Bellingham Drift aquitard. The leakage through the Bellingham Drift occurs over the entire aquifer aerial extent where the Deming Sand aquifer exists. Any effect on the saturated zone within in this aquitard from stormwater control and diversion is not expected to be measurable. Hence, the leakage and recharge to the Deming Sand aquifer would not be impacted in the immediate basin comprising 17 square miles.

5. BUILT ENVIRONMENT

This section provides information regarding surface and groundwater management during the construction and operational phases of the proposed Cogeneration Project. Water rights, public water supplies (including quantities, qualities, and treatment), potential sources of contamination, and wastewater treatment are discussed. NPDES applications for construction and operational stormwater discharges are also presented.

5.1 Applicable Water Rights, Permits, Certifications, and Claims

Water used for industrial purposes within the Cogeneration plant is to be supplied by the PUD, from recycled water used for non-contact cooling at the nearby Alcoa aluminum smelter. The PUD currently supplies water to both the Alcoa smelter and the Refinery from the Nooksack River pursuant to certified surface water diversion rights. ~~through a current contract between the BP Refinery and Whatcom County Public Utility District (PUD). This water is untreated surface water diverted from the Nooksack River. Potable~~ Potable (treated) water used within the Cogeneration plant is to be provided by Birch Bay Water and Sewer District (District). The District currently purchases water from the City of Blaine according to Department of Health data.

Surface and ground water certificates and permits recorded by Ecology for PUD, the District, and the City of Blaine are supplied in Table 5.1-1. Pending surface water and groundwater applications recorded by Ecology for PUD, the District and the City of Blaine are displayed in Table 5.1-2. A summary of water rights recorded by Ecology for both Terrell Creek, the Nooksack River and their tributaries that are within WRIA 1 and Whatcom County are summarized in Attachment F, Table 1.

The Department of Health also tracks water supplies through its System for Automated DWAIN Information Extraction (SADIE) database. Water systems are grouped into systems based on size; group A systems generally serve 15 or more connections while group B system serve two to 14 connections. The Public Water System ID for the BP Cherry Point Refinery is 3315. Public water system source information for Whatcom County obtained from the Department of Health is shown in Attachment F, Table 2 (Group A systems), and Table 3.

5.2 Water Supply and Consumption

Water used for industrial purposes within the Cogeneration plant would be supplied by the PUD from recycled water used for non-contact once-through cooling at the nearby Alcoa aluminum smelter. Industrial water would be delivered by the PUD to the Cogeneration Project via the existing 24-inch diameter pipeline to the Refinery. A separate connection would be made at the existing meter location in the southeast portion of the Refinery, and a 16-inch diameter pipe installed to serve the Cogeneration Project. This pipe would be located on BP property.

~~through a current contract between the BP Refinery and Whatcom County Public Utility District Whatcom County supplies this water from the Nooksack River under their certified surface water diversion rights.~~ Potable (treated) water used within the Cogeneration plant would be provided by the District. The District currently purchases water from the City of Blaine according to Department of Health data. The City of Blaine water supply is received from groundwater sources under certified groundwater withdrawal rights.

The Cogeneration Project would require an average of 2,244 to 2,316 gpm of industrial water. The PUD is expected to be able to provide an average of 2,780 gpm of recycled cooling water; the 484 to 556 gpm of recycled water in excess of the Cogeneration Project requirements would be used at the Refinery to reduce the water needed from the Nooksack River.

The Refinery's water use would also be reduced 20 gpm as a result of steam provided by the Cogeneration Project. The total water consumed by the Refinery and Cogeneration Project would average 6,414 to 6,486 gpm.

~~The Cogeneration Project would minimize water consumption by using an Air Cooled Condenser (ACC) instead of water intensive evaporative cooling systems. The Cogeneration Project is evaluating the potential for reuse of industrial wastewater in an evaporative cooling system, although this alternative is not currently proposed. The proposed Cogeneration facility would result in a net increasewater consumption of only 40 gpmWater will be supplied to the Cogeneration Project from the Refinery via an 8-inch diameter pipe. Currently, the Refinery receives an average of 4,170 gallons per minute (gpm) of fresh water from the Whatcom County PUD. The total combined water consumption from the Whatcom County PUD during operation of the Refinery and Cogeneration facilities will average 4,210 gpm. The ACC was selected to minimize the consumption of water. The use of ACC instead of water intensive evaporative cooling systems requires higher capital expenditures and results in lower electrical output (less efficient heat rate).~~

The Cogeneration plant will require slightly more water to make steam for the Refinery than do existing refinery boilers due to the more stringent water purity requirements of the Cogeneration plant; the above water use numbers take this into account. ~~At the same time, the recycling of used water from the Cogeneration facility results in a very efficient system, and the production of power from minimal existing resources. The Cogeneration Project will share water use with the Refinery, thus minimizing the consumption of water. The use of an ACC instead of an evaporative cooling system represents a dramatic reduction in the consumption of water for the Cogeneration Project. In addition, the~~ To further conserve water, boiler feed water blowdown from the Cogeneration Project will be recycled for use in the ~~Refinery~~Project's cooling tower. ~~The proposed system will only require an average of 40 gpm additional fresh water than is currently required for the Refinery.~~ A summary of the Refinery water consumption and the anticipated Refinery and Cogeneration Project water consumption is illustrated in Figure 5.2-1. More details on the integration of water between the Cogeneration Project and the Refinery is provided in Part III, Appendix D: Project Description Technical Report.

The Cogeneration Project's average water usage is summarized in Table 5.2-1. The Base and Worst Cases in this table depict average operation at 15 cycles of concentration and 10 cycles of concentration respectively, assuming an average of 510 thousand pounds per hour (kpph) steam demand by the Refinery. Cooling tower cycles of concentration are typically maximized to conserve water and treatment chemicals, but may change if makeup water quality changes. As shown in Table 5.2-1, on an annual average basis, withdrawal of water from the Nooksack River for industrial purposes is reduced by between 484 to 556 gpm.

The Cogeneration project's water consumption would also vary with changes in the ambient temperature and the Refinery steam demand. Warmer ambient temperatures in the summer increase water use and cooler ambient temperatures in the winter decrease water use as a result of changes in evaporation rates in the cooling tower. As the Refinery's steam demand is reduced and consequently more steam is used for generation of electricity, more heat rejection duty is required of the cooling tower to condense steam in the steam turbine exhaust condenser.

The Cogeneration Project's maximum water usage may at times exceed the average quantity of recycled water available from Alcoa during periods of high ambient temperatures. However, the additional water requirement is not significant compared to existing variations in PUD withdrawals and the Nooksack River flow rates. Table 5.2-2 shows the predicted average Cogeneration Project water use during the warmest single day and warmest three-month period over the 1995-2002 time period studied.

An agreement for industrial water purchase exists between Whatcom County PUD and BP. This agreement is for the purchase of water of up to 11 mgd (7640 gpm) from the PUD, from January 1, 2000 to December 31, 2030. The point of delivery will be at the existing Refinery meter. The water is of industrial grade, non potable and is to be produced, delivered, and sold under the agreement having an average turbidity quality of 10 NTUs or less, allowing for occasional turbidities of greater than 10 NTUs for short periods that may occur due to the type of treatment facilities used and the raw Nooksack River water quality.

5.2.1 Whatcom County PUD Water Quality Characteristics

Chemical analysis of the Whatcom County PUD source water quality that would be used for once through non-contact cooling at Alcoa and then in the Cogeneration Project for industrial make-up water is presented in Table 5.2-~~1~~3.

5.2.2 Water Treatment Requirements and Methods

Water for the HRSGs must meet stringent specifications for suspended and dissolved solids. To meet these specifications, fresh water is first filtered and passed through a ~~packed bed~~ demineralization plant. The effluent from the ~~primary~~ demineralizer is then sent to a polishing mixed bed demineralizer. Demineralized water from the polisher flows to the Demineralized water storage tank. This tank provides an uninterrupted supply of demineralized make-up water to the steam cycle.

A chemical feed system would provide additional conditioning of the water in the steam cycle. An oxygen scavenger for dissolved oxygen control would be fed directly into the ~~integral deaerator~~ deaerating condenser and amine for pH controls is fed into the condensate. To ~~minimize~~ prevent scale formation, a solution of alkaline phosphate would be fed into the feed water of the HRSG.

A steam cycle sampling and analysis system would monitors the water quality at various points in the plant's steam cycle. The water quality data would be used to guide adjustments in water treatment processes and to determine the need for other corrective operational or maintenance measures. For additional details, see Part III, Appendix D, Technical Report on Project Description.

5.3 Potential Onsite Sources of Contamination

Potential onsite sources of contamination are described in this section. A more complete description of construction and operational potential sources of contamination from the proposed Cogeneration Project is presented in Part III, Appendix: D: Project Description Technical Report. The Cogeneration Project will utilize best management practices (BMPs) to be in compliance with applicable regulations for the transportation, handling, storage, and use of fuels, oils/greases, chemicals, and waters having undesirable constituents. Potential contaminant sources would exist onsite during the construction activities and during facility operations, which are discussed separately below, along with planned measures to minimize the potential for an uncontrolled release to the environment.

A Spill Prevention, Control, and Countermeasures (SPCC) Plan will be developed and implemented. The SPCC Plan will describe the procedures and technologies in place to prevent and minimize the occurrence and consequences of chemical spills. The SPCC for the Cogeneration Project will be modeled after the existing SPCC Plan for the BP Cherry Point Refinery, with appropriate site-specific modifications.

5.3.1 Chemicals Used and Wastes Generated During Construction

Table 5.3-1 lists typical chemicals that are generally used at a construction project of this type. Estimated annual consumption is also provided. A complete list of anticipated wastes that would be generated on site during construction and waste management methods that would be used are included in Table 5.3-2.

A Stormwater Pollution Prevention Plan (SWPPP) will be prepared and implemented for construction activities, which will include worker training, refueling procedures, and operational/structural controls to minimize the potential for spills and leaks from occurring. The structural controls being proposed include, an oil water separation system with shut off values to contain oil/hydrocarbon releases.

To minimize the potential release of chemicals during construction, best management practices will be employed. These will include good housekeeping measures, inspections, containment facilities, minimum on site inventory, and spill prevention practices. Construction personnel will be instructed regarding the management requirements, and the Applicant's on site Project Manager will be responsible for their implementation.

Portable sanitation units will be used during construction of the power plant. These units will be maintained on a regular basis, and a licensed Sanitary Waste Management Contractor will collect waste from the units for disposal in accordance with applicable regulations. Sanitary waste generation is anticipated to be 500-gallons per day in conjunction with the construction phase.

All construction waste materials will be collected, deposited, and stored in appropriate containers provided by a licensed Solid Waste Management Contractor. The Waste Management Contractor will remove the containers and recycle or dispose of the material in accordance with applicable regulations. No construction waste material will be burned or buried on site. The on site Project Manager will instruct all site personnel regarding proper waste disposal procedures.

The potential sources of contamination that exist during construction of the Cogeneration Project include:

- Fuels, lubricants, hydraulic fluids and anti-freeze agents used for machinery, heavy equipment and vehicles;
- Cleaning agents for machinery and equipment; and
- Paints and paint solvents.

Construction machinery fluids including diesel fuel, gasoline, motor oil, hydraulic fluid, brake fluid, and anti-freeze could potentially spill during construction. The contractor's responsibility includes implementation of the SWPPP and training of all construction personnel and subcontractors in spill avoidance and, if spills occur, in containment, clean up, and reporting procedures consistent as appropriate with applicable regulations and the current Refinery practices.

Construction equipment refueling will be closely supervised to avoid leaks or releases. Should a spill occur during refueling, it will be properly cleaned up by the general contractor and reported. If fuel tanks are used during construction, the fuel tank(s) will be located within a secondary containment with an oil proof liner sized to contain the single largest tank volume plus an adequate freeboard allowance for rainwater. Lubrication oil stored on site in barrels will be temporarily stored in a secondary containment area to contain any spillage or in temporary warehouses.

5.3.2 Plant Commissioning and Hydrostatic Test Water

Testing of equipment is necessary before plant startup and will require water. This test water includes test water for commissioning the HRSGs and hydrostatic water for testing seals and water systems and is itemized in Table 5.3-3. The water for the testing of the power plant facilities, natural gas pipeline connections, and water supply/discharge connections will be supplied by the Whatcom County PUD.

The volume of water needed for the HRSG steam-blow testing is anticipated to be about 15.5 million gallons, for export steam line steam-blow testing will be about 1.2 million gallons, and for hydrostatic testing will likely not exceed ~~3~~ 4.8 million gallons. Plant commissioning and testing will occur over a time period as specific components are built and become ready for testing.

Water used for HRSG steam-blow tests are discharged as steam to the atmosphere. Water used for hydrostatic testing will ~~require captured and~~ be processed in the Refinery wastewater system. The quality of the water will be tested and be within acceptable limits. After treatment, the hydrostatic test water will be discharged to the Strait of Georgia through Outfall 001. No adverse environmental impacts are expected.

Chemicals Used and Wastes Generated During Operation and Maintenance Operational Chemicals:

Prior to operation of the Cogeneration plant, a SPCC Plan will be prepared prior to operational activities, which will contain spill response, containment, and prevention procedures. The SPCC Plan for operation of the plant will include structural, operational, and treatment BMPs. Structural BMPs include impervious containment, covers, and spill control kits. Operational BMPs include good housekeeping, employee training, spill prevention, preventative maintenance, and inspections. Treatment BMPs include ponds and oil water separators as discussed above. The chemicals that would be used and stored at the generation plant during operation and maintenance are listed in Table 5.3-4.

A number of safeguards will be incorporated to mitigate the risks of a release to the environment from stored operational chemicals. These include but are not limited to secondary containment, tank overfill protection, routine maintenance, safe handling practices, supervision of all loading/unloading by plant personnel and the truck driver, and appropriate training of operation and maintenance staff. Table 5.3-5 identifies storage tanks and major equipment that would store liquids during operation of the Cogeneration Project. The following gives a brief description of the spill prevention and control features to be installed with each tank:

The demineralized water storage tank, returned condensate storage tank and the demineralization system neutralization tanks would not be provided with spill containment.

The following tanks hold diesel fuel oil for the emergency generator and fire water pump or lube oil for major rotating equipment. These tanks will be provided with secondary containment for spill control with adequate freeboard for rainwater.

> The fire pump diesel fuel storage tank will be a horizontal tank with a capacity of approximately 460 gallons and dimensions of 4 feet diameter x 5 feet long.
>
> The diesel generator diesel fuel storage tank will be a vertical tank with a capacity of approximately 1,500 gallons and with dimensions of 6 feet diameter x 8 feet high.

The steam turbine lube oil storage tank will be a rectangular tank with a capacity of approximately 7,200 gallons and with dimensions of 24 feet long x 12 feet wide x 7 feet high. Depending on the supplier of the steam turbine, the electro-hydraulic control oil system may be integrated with the lube oil system or it may be a standalone system.

One combustion turbine lube oil storage tank will be provided for each of the three CGTs. Each tank will have a capacity of approximately 6200 gallons and with approximate dimensions of 28 feet long x 10 feet wide x 4 feet high. These lube oil tanks are located inside the accessory module that is furnished as part of the CGT vendor scope of supply.

Transformer Oil

> Transformers will be installed into secondary containment areas that will hold the transformer's volume plus an adequate freeboard to accommodate rainwater. Transformer oil will be pumped from a truck within a temporary secondary containment area. Spills that occur during filling of the transformer will be properly cleaned up and reported.

Anhydrous Ammonia Tank

A secondary containment area will be constructed around the ammonia tank that will contain 150% of the working volume. The additional containment is provided to accommodate water from a deluge spray system and rainwater.

Caustic Tanks

The caustic tanks will be surrounded by a secondary containment area and sized with sufficient freeboard for rainwater.

Acid Tanks

The acid tanks will be located within a secondary containment area lined with an acid-proof coating and sized with sufficient freeboard for rainwater.

Steam Cycle and Cooling Tower Chemicals

Oxygen scavenger, neutralizing amine, corrosion inhibitors, ~~and~~ phosphate and cooling tower chemical storage tanks will be ~~located indoors and will be~~ contained in a curbed area sufficiently sized to contain the volume of the single largest storage tank.

Oil-Water Sewer

The BP Cogeneration facility will be provided with an oil-water sewer (OWS) system that collects water from selected equipment drains and work area drains where rainfall and washdown runoff could contain oil. Collected drainage and runoff will be pumped to the existing Refinery wastewater treatment system.

Operational Wastes:

Very little solid or dangerous waste would be produced during the operation and maintenance of the Cogeneration plant. The used lubrication and transformer oils, small quantities of used paints, thinners, and solvents used during operation and maintenance will be recycled or disposed of in accordance with federal, state, and local regulations. Any dangerous wastes generated by the plant will be managed to ensure compliance with Washington Dangerous Waste Regulations (173-303 WAC). Dangerous wastes will be limited to solvents and paint wastes generated during maintenance activities. A waste generator number has not yet been assigned. A complete list of anticipated waste streams that would be generated during operation and maintenance are included in Table 5.3-6.

5.4 Wastewater Streams, Treatment Facilities, and Discharge

During normal operation, the Cogeneration plant will generate wastewater from the following types of activities:

- Treatment of raw water to produce high quality boiler feedwater (BFW)~~;~~; and Refinery return condensate treatment;
- Collection of water and/or other minor drainage from various types of equipment; ~~and~~
- Sanitary waste collection; and~~.~~
- Cooling tower blowdown.

With the exception of the sanitary waste, these wastewater streams will be discharged through the Refinery wastewater treatment system as described below. Sanitary wastes will be discharged to the District's treatment system in accordance with the terms and conditions of an Agreement between BP and the District. The District has confirmed that it has the capacity to accommodate the incremental combined sewage loading from the Refinery and the proposed Cogeneration facility.

The boiler feed water blowdown from the Cogeneration Project will be reused in the ~~Refinery~~ Project cooling tower and is not considered a waste stream. ~~There would be the potential for other wastewaters from the Cogeneration Project to be reused in the Refinery, but this alternative will depend on the available flow, reliability, water quality, and other parameters. The Refinery and the Cogeneration Project will continue to explore the potential for reuse of the Cogeneration wastewater and industrial wastewaters that may improve cogeneration efficiency without increasing water consumption from local supplies.~~

The estimated flow and chemical composition of wastewaters from the Cogeneration Project are provided in Table 5.4-1, except for the sanitary wastewater stream. The chemical composition of the wastewater was determined based on the assumption that the quality of the water received from Alcoa would be comparable to the water quality of industrial water currently provided by the Whatcom County PUD. This assumption is reasonable because Alcoa uses the water for non-contact once through cooling, which means that no contaminants are added and little concentration occurs through evaporation. The potential impact of the Cogeneration Project contribution to the existing Refinery wastewater discharge is provided in Table 5.4-2.

There would also an intermittent wastewater stream generated when a gas turbine is shut down to wash the turbine blades and restore peak operating efficiency. This is done an average of ~~twice~~ once per ~~year~~ quarter for each gas turbine, depending on blade fouling severity. Approximately ~~1,250~~2,300 gallons of wastewater ~~is~~ are generated during each washing that contain~~s airborne~~ dirt accumulations that have been removed from the blades, along with detergents used for the cleaning operation. The water is collected in a sump and ~~either pumped or~~ trucked offsite ~~to the Refinery~~ for proper disposal.

The streams that would be generated during normal operation of the Cogeneration Project represent the majority of the wastewater flows and would be handled as follows:

- Raw water treatment and Refinery return condensate treatment system waste~~HRSG Blowdown~~

  Filters would be used to remove the relatively small amount of suspended solids present in the ~~raw~~ industrial water received from the PUD~~refinery~~. Filtration would be required as a first step in the production of high quality boiler feedwater (BFW). Periodically, each of the ~~three~~ filters in the unit would be backwashed to remove the solids from the filter media. The backwash water would be ~~collected in a large tank (Neutralization Tank) which would be periodically~~ pumped to the ~~r~~Refinery's ~~oil~~ wastewater system for treatment.

  The condensate being returned from the Refinery to the Cogeneration Project will be treated to remove any trace oil through a precoat filter system. When the precoat filter material is replaced, the spent precoat material (a mixture of powdered cellulose and powdered activated carbon) would be collected in a tank and dewatered for disposal along with other primary sludge generated within the Refinery. The water removed as a result of the dewatering process would be sent to the Refinery wastewater treatment plant.

Ion exchange units would also be used in treating raw water~~,~~ and condensate returned from the Refinery~~, and BFW sent to the Cogeneration plant from the Refinery in exchange for exported steam~~. Dissolved ionic species must be removed in order to generate high-pressure steam in the HRSGs without fouling or corroding the boiler tubes. The resins in the ion exchange units eventually would become saturated as their capacity for removing ions has been reached. It would then be necessary to regenerate these resins with dilute sulfuric acid and sodium hydroxide. These chemicals, along with the removed ions and rinse waters, would be collected in the Neutralization Tank, neutralized to a pH between 6.5 and 8.5, then pumped to the Refinery. The filter backwash would be pumped to the Refinery's wastewater treatment plant.~~also be part of this stream.~~

- Equipment Drains

  Pumps, compressors, turbines, and other equipment generate a very small quantity of wastewater due to leakage or periodic flushing operations. Since this wastewater has the potential to contain free oil, it is collected separately in a sump and pumped to the Refinery's oil-water sewer for treatment.

- Sanitary Waste

  Since the Cogeneration plant would have operating and administrative personnel, there would be sanitary waste requiring collection and removal. . This waste would be collected in a sump and pumped to the Refinery's sanitary system for disposal. As indicated above, BP is proposing to discharge the sanitary sewage from both the Refinery and the Cogeneration facility to the District's treatment system. The District and the Refinery have entered into an agreement for this discharge. The District has confirmed that it has the capacity to accommodate the additional loading to their sanitary sewage wastewater treatment system to accommodate the flows from the proposed Cogeneration Project, which are considered incremental to the overall inputs to the system.

- Cooling Tower Blowdown

  The blowdown from the Cogeneration Project cooling tower will be held in an equalization tank with the other cogeneration wastewater streams (except sanitary wastes) and pumped at a controlled rate to the Refinery wastewater treatment system.

5.5 Best Management Practices for Stormwater Management

Stormwater Pollution Prevention Plans (SWPPP) for both construction and operational activities will be prepared for the plant site, and will include stormwater management procedures. The SWPPP for construction will include a Temporary Erosion and

Sediment Control (TESC) Plan for each phase of the Cogeneration Project site. The SWPPP and TESC Plans will include the specification of all necessary BMPs for construction activities. The grading plan for the site will also specify the necessary BMPs for erosion. All erosion control BMPs will be in place and functioning prior to the start of construction.

The SWPPP for operational procedures, in conjunction with the SPCC Plan will provide structural, operational and erosion/spill control BMPs for all stormwater operational activities of the plant site, water supply pipeline, water discharge pipeline, and transmission line.

5.5.1 Stormwater Detention and Control

Stormwater will be controlled and detained during construction and operation of the Cogeneration Project using wet ponds, which provide both treatment and detention of stormwater. These will be sized for storm events ranging from 6-month, 24-hour event, up to the 100-year, 24-hour events. The storm events, precipitation amounts, and details including detention pond size, treatment systems and conveyance systems are provided in Attachment A, *"Cherry Point Cogeneration Project Stormwater Management System Design Basis"* and supplemental technical memoranda, prepared by Golder Associates Inc. (December 20, 2001 and March 2003).

Stormwater will be discharged initially to an oil/water separation system equipped with a shut-off valve for containment and emergency spill control equipment. This system will allow containment of an accidental spill for removal and cleanup before the contaminants reach the detention pond. The stormwater from the oil/water separation system will be routed to wet ponds for final treatment/detention before discharge to adjacent wetlands.

The SWPPP for Construction will include a Temporary Erosion and Sediment Control Plan, the required twelve SWPPP elements (including but not limited to spill response, spill containment and spill prevention procedures), and general operation and maintenance descriptions of the BMPs used on site. This plan will be completed and on-site for implementation upon commencement of construction. The SWPPP for Operation will include structural and operational BMPs, a SPCC Plan, a final stormwater management plan, and general operating procedures. This plan will be completed and on-site upon commencement of plant operation.

Similarly, stormwater runoff will be managed during construction and operation of the ancillary facilities such as the water supply and discharge connections, gas line connections, and access roads using appropriate BMPs. It is anticipated that potential increases in runoff and turbidity associated with these components will be minimal, and easily managed with the aforementioned BMPs. During operation of the water supply and distribution connections and of the transmission line corridor, the surrounding area would return to a vegetative state, therefore increased stormwater runoff or erosion during operation of the facility will not be an issue.

The electrical transmission connection from the Cogeneration Project to the BPA Transmission Corridor is shown on Drawings AD-00-4300-00108 and AD-00-4300-00109. The 150-foot wide electrical transmission line corridor has not yet been cleared of trees, although the access/maintenance roads leading to the transmission line corridor have been developed. Three pads for the transmission towers have already been constructed. The gravel pads are approximately 50 feet by 50 feet. One additional pad will be constructed at a later date adjacent to the existing BPA Transmission Corridor. There are two gravel access roads, approximately 15 feet wide, which have been developed for construction and access of the transmission pads and footings. These pads and access roads were constructed under an existing JARPA permit. BMPs including silt fences, straw bales and munching will be used as necessary for the clearing the corridor and construction of the remaining tower pad to control erosion until the area can be stabilized with gravel or vegetation. The transmission connection access roads and tower pads allow stormwater infiltration to occur and will not increase the amount of stormwater runoff. The surrounding areas are undisturbed grassland and forest.

5.5.2 Construction NPDES Stormwater Permit Application

The NPDES permit application for facility construction is included in Attachment G. This application has been prepared to the extent possible at this time. It will be updated and completed when the design of the Cogeneration Project has been finalized and prior to construction. An associated Construction SWPPP will also be prepared prior to construction.

5.5.3 Operational NPDES Stormwater Permit

The NPDES permit application for facility operation is included in Attachment H. This application has been prepared to the extent possible at this time. It will be updated and completed when operating procedures for the Cogeneration Project become established prior to facility operation. An associated Operational SWPPP and a SPCC Plan will also be prepared prior to the start of facility operation.

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FIGURES

DRAWINGS

ATTACHMENT A

CHERRY POINT COGENERATION PROJECT
STORMWATER MANAGEMENT SYSTEM
DESIGN BASIS
AND
SUPPLEMENTAL TECHNICAL MEMORANDA

ATTACHMENT B

SELECTED POTENTIOMETRIC SURFACE MAPS FROM GROUNDWATER INVESTIGATIONS AT THE BP CHERRY POINT REFINERY

(1991-1993)

Source: Remediation Technologies, Inc. 1993

ATTACHMENT C

HYDROGRAPHS OF NESTED PIEZOMETERS AT THE BP CHERRY POINT REFINERY

Source: Remediation Technologies, Inc. 1993

ATTACHMENT D

BP CHERRY POINT REFINERY SOIL SAMPLE TESTING RESULTS

Source: Remediation Technologies, Inc. 1993

ATTACHMENT E

GROUNDWATER HYDRAULIC TESTING RESULTS AT THE BP CHERRY POINT REFINERY

Source: Remediation Technologies, Inc. 1993

ATTACHMENT F

WATER RIGHTS TABLES

ATTACHMENT G

DRAFT CONSTRUCTION STORMWATER NPDES PERMIT APPLICATION FORM

ATTACHMENT H

DRAFT OPERATIONAL STORMWATER NPDES PERMIT APPLICATION FORM